Fall 2009

CS/MTH 316/516: Numerical Methods for Digital Computers

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CS/MTH 316/516 Survey of Numerical Methods for Computational Science

Section 1 – Fall 2009 Tu Th 6:05 – 7:20 p.m., Russ Center 148
Section 2 – Fall 2008 Tu Th 2:15 – 3:30 p.m., Oelman Hall 341
Last Update: September 4, 2009

Description: Introduction to numerical methods used in the sciences and engineering. Included will be methods for interpolation, data smoothing, integration, differentiation, and solution of systems of linear and nonlinear equations. Discussion of sources of error in numerical methods. Applications to science, engineering and applied mathematics are an integral part of the course. Special topics presented as schedule permits. Four hours lecture.

Prerequisites: (CS 142 or CS 241 or CEG 220) and MTH 231 and (MTH 235 or MTH 253 or MTH 255). Course descriptions at: http://www.wright.edu/academics/catalog/descriptions.html

Instructor: Dr. Ronald F. Taylor, RC 340, 775-5122, ronald.taylor(at)wright.edu, office hours: 11:00 a.m. – Noon on Monday and Wednesday and 4:00 – 5:00 p.m. on Tuesday and Thursday (other times by appointment).

Required Textbook: Numerical Computing with MATLAB, Cleve B. Moler, Society ofr Industrial and Applied Mathematics (SIAM), ISBN 978-0-898716-60-3. Paperback copy in Wright State Bookstore. Free online copy and software at: http://www.mathworks.com/moler/index_ncm.html

Course Home Page and WebCT: http://www.cs.wright.edu/people/faculty/rtaylor/cs316 available by the start of second week of class. We will also be using WebCT for posting of grades and submittal of some assignments or portions of assignments. Students should familiarize themselves with accessing WebCT: http://wisdom.wright.edu/. Students are also responsible for accessing the Course Home Page or WebCT for printing copies of resource materials. Some handouts will be given in class.

Programming: Writing and using numerical programs is an important part of this course. Programming assignments require MATLAB which is avalable on a number of Wright State systems. Many times numerical work can be done on a scientific or programmable calculator. MATLAB is very useful, and you may want to consider purchasing the Student Edition if you have a PC that can support it. It can be purchased online at http://www.mathworks.com/academia/student_version/ directly from MathWorks. The Symbolic Math Toolbox which comes with the Student Edition will be discussed in lecture and maybe useful for some assignments. It is expected that students will spend a minimum of 2 hours per week working in a computer lab or equivalent environment enhancing their programming skills and completing programming assignments for this course. If you feel you need to use a language other than MATLAB, please meet with the Instructor and discuss.

Computers and Computing Accounts: You must be able to access the Web and have a WSU Student Login to Wings, e-mail, and WebCT. Check your WSU e-mail on a regular basis for any course announcements from the Instructor. Get familiar with the use of the PCs in Russ Center 152C to access MATLAB if you do not have it on your own PC. Needed computing topics be covered in class and handouts or web citations given as appropriate. Check the University computing information at http://www.wright.edu/cats/studentzone.html as well as that for the College of Engineering and Computer Science at: http://www.cs.wright.edu/help/services.shtml

Use of E-Mail: All registered students will have access to a Wright State e-mail account. The Instructor will use only that e-mail account to initiate communication with student. The Instructor will reply to other e-mail accounts. IMPORTANT: Please include in any communication with Instructor, a Subject which starts with "CS316" (or CS516, MTH316, MTH516). For example, a student with a question about HW 1, would use as a Subject: "CS316: Question on HW 1 Problem 2."

Grading Policy: Mid-term exam and quizzes – 35% . One comprehensive final – 40%. Homework/Project assignments – 25%. Quizzes may be in class, take-home, or in-office Q&A: points included with mid-term score. Students registered at the graduate level (i.e. CS 516 or MTH 516) will be required to complete extra problems, programs and/or special projects as part of the Homework/Project component of this course. Expect about six major Homework/Project assignments. A number of problems assigned may be considered "practice" and will not be graded. In general, one week will be given to prepare these assignments. Smaller homework problems/investigations may be due the next class period. Follow the "Homework Standards" posted on the course website. IMPORTANT: Submit any specified program files to be graded via WebCT only -- materials sent by e-mail will not be graded. Course Grade Based on Average:

A: 100-90, **B**: less than 90-80, **C:** less than 80-70, **D:** less than 70-60, **F:** less than 60-0.

Class Policies: No late or early exams unless verifiable emergency. No make-up quizzes: quizzes may be unannounced. No section swapping for Exams, Quizzes, or HW submittals. Attendance at lecture is not a component of your grade. However, students are expected to attend all lectures and to participate in class discussion. Attendance may be taken in the course to better get to know students. In cases of infrequent attendance, lower homework and exam grades will inevitably result since a significant portion of lecture material is not covered in the text. All Homework/Project assignments are due at the start of class and/or in WebCT on the date and time specified. Grades on late assignments will be reduced by 10%. Submittals more than one day late will not be graded - "zero" grade assigned. Exceptions to the above policies may be made unusual circumstances when documentation is provided in writing -- otherwise expect strict enforcement of the policies. All work submitted must be your own unless group assignments are explicitly made by the Instructor; sharing of program code or copying problem solutions/codes from any source will result in at least a homework grade of "zero" for all involved and possibly a grade of "F" for the course. University procedures for plagiarism will be strictly followed. Sharing ideas and general mathematical and computer skills with others outside of class is encouraged. Students are expected to read, understand and follow the University Academic Integrity Policy at:

http://www.wright.edu/students/judicial/integrity.html

Supplemental Class Information and Homework Standards: A document: "Supplemental Information" is given on the course website which clarifies and details how the above class and grading policies are to be implemented. Also carefully study and follow the "Homework Standards" document on the course website. Students are responsible for understanding these documents referring to them during the quarter as needed. Please ask for clarification if you have questions on either of these two important documents.

Schedule: Topics may vary. **Exams dates and times** are firm. "Chapter" and "Section" is the Required Textbook Section and "Notes" are from lecture.

Week	Topics/Activity	Text Reading
1	Introduction, Review of Calculus and Programming	Chap 1and Notes
2	Software, Number Representation and Types of Error, Algorithm Stability, and Programming Considerations	Chap 1 and Notes
3	Solving a Nonlinear Equation in One Unknown	Chap 4 and Notes
4	Introduction to Linear Equations, Gaussian Elimination, and Factorization Methods and Special Systems	Chap 2 and Notes
5	Iterative Solution of Linear Equations: Jacobi, Gauss-Seidel, SOR, Exam Review, and **Mid-Term Exam: Th October 8, 2009 (full period) No Section Swapping.**	Notes
6	Eigenvalues and Eigenvectors: Basic Properties and Power Method with Extensions	Chap 10 and Notes
7	Curve Fitting: Polynomial and Spline Interpolation. Least Squares Approximation	Chap 3 and 5
8	Numerical Differentiation, Finite Differences, and ODEs	Chap 7 and Notes
9	Integration: Trapezoid, Simpson, and Romberg	Chap 6 and Notes
10	Integration (concluded): Gaussian Quadrature, Multiple Integrals, Singular Integrals, Infinite Domain Integrals, Evaluation of Instruction, and Exam Review	Chap 6 and Notes
Finals Week	**Comprehensive Final Exam: Th November 19, 2009, No Section Swapping.** **8:00 – 10:00 p.m for Section 1 (6:05-7:20 usual meeting time)** **3:15 – 5:15 p.m. for Section 2 (2:15-3:30 usual meeting time)**	